

# The Impact of Information and Communication Technologies on the Performance of Human Resources Management and the Mediating Role of Artificial Intelligence

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## ABSTRACT

This study examines the effect of information and communication technology (ICT) on human resource management performance through the mediating role represented by artificial intelligence (AI) within human resource departments and the IT division. Using survey data including 179 respondents and a factor analysis framework, we find that ICT engagement, as measured by management decision support systems, enterprise resource planning (ERP), data access and analysis (DAA) technologies, process support and improvement (PSI) technologies, and communication technologies, has a positive and statistically significant effect on human resource management performance. Similarly, we find that artificial intelligence and information and communication technologies are positively associated with human resource management performance. The results imply that companies should do their best to promote and facilitate the engagement of ICT and AI to improve their HRM performance as well as their information system, which will produce positive results for the company structure.

**KEYWORDS:** Artificial intelligence, Information and Communication Technology, Human capital, Human performance

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## 1. INTRODUCTION

The change of the human resources function due to the new technologies has burst into the economic, political and social life of the company, thanks to this technologies; it has posed the direction of human resources of important data with great will has data base, relatively human resources skills trainings (...) to the account on the profile analysis.

With the speed of change and the transfer of technologies, human resources have become the most important variable in the world. As HR processes evolve, the company must leverage its resources and strengthen its competitive advantage. Thus, with artificial intelligence (AI), human resource practices and collaborative work could evolve and meet the needs of these developments. In this sense, the question we could ask about the impact of artificial intelligence on the human capital and endurance experience collaborator. AI is an opportunity for HR teams to confirm their positioning as innovative entrepreneurs in the service of increased service quality.

The arrival of Artificial Intelligence (AI) is bringing about major changes in the recruitment value chain. It is up to leaders and managers to accompany their teams in this

profound change in order to alleviate fears, welcome innovation, transform workstations, train teams, and above all, take advantage of this technology by ensuring that everyone benefits... AI is increasingly used in the recruitment sector. It is profoundly transforming the business and changing the recruitment process: it discerns patterns and relationships faster and better than software or humans.

This allows them to focus on the search process in order to draw conclusions that reflect the real world of artificial intelligence based on the assumption that "AI boosts productivity and efficiency". If this is a strong argument for the adoption of these technologies, it represents a major upheaval for the sector: it is now necessary to adapt skills but also to anticipate the evolution of the daily tasks of each profession in the value chain. In addition to human resources (HR) management is a set of approaches aimed at recruiting, developing, motivating and evaluating employees in order to achieve the organization's objectives.

The goals and strategies of the company's business model form the basis for HR management decision-making. Human resource management practices and systems include the

company's human resource decision support system, which is designed to make employees a key element in achieving a competitive advantage. From this perspective, the human resource management mechanism includes the following sequential activities: Job analysis and design, human resources planning and forecasting, employee recruitment, employee selection, training and development, performance planning and evaluation benefits and compensation.

Human Resource Management (HRM) is an organizational and strategic function dedicated to the management of all people involved in achieving business success and competitive advantage, often performed by a Human Resources (HR) department.

## 2. Literature Review

### A. Performance GRH

Human resource management (HRM) is a function of organizations aimed at maximizing the performance of employees in support of their employer's strategic objectives. (HRM in changing organizational contexts, 2009). HRM is primarily concerned with how people are managed within organizations, focusing on policies and systems (Human resource management: A critical approach, 2009). HR departments and units in organizations are typically responsible for a number of activities, including employee recruitment, training and development, performance appraisal and reward. HR is also involved in industrial relations, balancing organizational practices with regulations resulting from collective bargaining and government legislation.

Dave Ulrich lists the functions of HR: aligning HR with business strategy, re-engineering organizational processes, listening and responding to employees, and managing transformation and change. (Boston, Mass., 1996) At the macro level, HR is responsible for overseeing the leadership and culture of the organization. HR also ensures compliance with employment and labor laws, which differ by region, and often oversees health, safety and security. In cases where employees want and are legally entitled to a collective bargaining agreement, HR also typically serves as the primary liaison between the company and employee representatives (usually a union). As a result, HR, usually through representatives, engages in lobbying efforts with government agencies (e.g., in the U.S., the Department of Labor and the National Labor Relations Board) to promote their priorities.

Human resource management (HRM) is concerned with the "design of formal systems in an organization to ensure the effective and efficient use of human talent to achieve

organizational goals" (Mathis, Jackson 2000). HRM involves a series of activities and decisions related to workforce planning, job design and analysis, recruitment and selection, orientation, training and development, team building, compensation and benefits, promotion, motivation, employee involvement and participation, empowerment, performance evaluation, health and safety, job security, employee and worker relations, and terminations (Biswas and Cassell 1996; Boella 2000; Dessler 2000; Jerris 1999; Mathis and Jackson 2000; Tanke 2001). In recent years, a more strategic approach to HRM has been applied, in which employees are viewed as strategic and valuable assets to be invested in and developed, rather than as costs to be controlled. In this regard, a highly engaged, capable, empowered, involved, and motivated workforce is seen as the path to competitive advantage and sustainable business success (Storey 1995). To develop engaged, capable, satisfied, and motivated employees, authors have alluded to appropriate sets of HRM practices under different names, including high involvement practices, flexible production systems, high involvement systems, high performance work systems, and HRM best practices (Wood 1999).

High performance work systems are defined as "a set of distinct but interrelated HRM practices that together select, develop, retain and motivate a workforce: (1) who possess superior capabilities; (2) who apply their capabilities in their work activities; and (3) whose work activities enable these firms to achieve higher intermediate indicators of performance and sustainable competitive advantage" (Way 2002). High-performance work organizations are characterized by HRM practices such as selective hiring, extensive training, self-managed teams, decentralized decision making, reduced status distinction, information sharing, performance-based pay, job security, expanded job design, flexible assignments, employee involvement and commitment, internal promotion, employee ownership, transformational leadership, and high compensation based on group performance (e.g., earnings sharing, profit sharing), gain sharing, profit sharing) (Guthrie 2001; Pfeffer 1998; Way 2002; Wood 1999; Zacharatos, Barling, and Iverson 2005), and Iverson 2005).

### The functional tasks of human resources management

To meet and manage the talent and competency needs of the organization, the HRM function traditionally focuses on several functional tasks involving a number of established practices (Noe et al., 2020; Wirtky et al., 2016). Table 1 provides a brief description of these functional tasks and practices and their objectives (Oehlhorn et al., 2020; Wirtky et al., 2016).

Functional Task	Practices
Planning involves determining the number of employees and skills needed to best meet the organization's future business requirements.	The job analysis determines detailed information in terms of the technical and non-technical skills needed in the short and long term. Work design defines how work will be performed and the tasks that a given job entails. HR planning identifies the number and types of human resources needed to meet organizational goals.
Resourcing involves obtaining and productively using the human resources needed to meet organizational needs.	Internal staffing is the human resource needs with possible sourcing from within the organization. External recruitment searches for candidates from outside the organization for potential employment. Selection identifies the best candidates with the appropriate knowledge, skills and abilities.
Employee development is essential for organizations to improve employees' job performance and prepare them for future tasks or positions.	Performance management determines the results and performance of staff, compares them to goals and analyzes variances. Training provides employees with job-related knowledge, skills and behaviors. Development enables employees to acquire knowledge, skills and behaviors, improving their ability to respond to changing job requirements and customer demands.

Employee motivation is essential in highly competitive labor markets. Motivational incentives result in improved performance and loyalty.	Compensation manages salary rewards and benefits related to individual and team success. Talent management systematically retains employees and plans career opportunities. Employee relations maintain a positive work environment, enhance workplace collaboration and facilitate corporate communication with various stakeholders.
Administering and supporting other functional tasks through essentially repetitive practices is useful for establishing a cultural and legal environment and for reducing costs.	Personnel policies cover the beliefs, morals and desired behaviors to which human resources should adhere. Labor compliance ensures compliance with labor laws and regulations. Human resources control records, uses and analyzes human resources data to make evidence-based decisions.

## B. Artificial intelligence

The term artificial intelligence appeared in 1956 when Minsky, McCarthy, Newell and Simon met at Dartmouth College (New Hampshire, USA). It was a time of absolute enthusiasm (Simon in 1958): in less than ten years a chess program would reach the level of a world champion and a program for automatic theorem demonstration would discover a mathematical theorem. However, Kasparov was beaten by the Deep Blue machine only in 1997! Development of works: chess games, theorem proving in geometry. Appearance of the first program the Logic Theorist (automatic theorem proving) in 1956 and the IPL1 language. Appearance of the Lisp language in 1960 by Mac Carthy, and Prolog in 1971 by Alan Colmerauer. Eliza was built at MIT in 1965, an intelligent system that dialogues in English and plays psychotherapist (Arute et al., 2019).

From the 1980's onwards, specific computer science techniques were developed: neural networks that simulate the architecture of the human brain, genetic algorithms that simulate the process of natural selection of individuals, inductive logic programming that turns the usual process of deduction upside down, Bayesian networks that rely on probability theory to choose the most satisfactory of several hypotheses. The field is so vast that it is impossible to restrict it to a specific field of research; it is rather a multidisciplinary program. If its initial ambition was to imitate the cognitive processes of human beings, its current objectives are rather to develop automata that solve certain problems much better than humans, by all available means. Thus, AI comes at the crossroads of several disciplines: computer science, mathematics (logic, optimization, analysis, probabilities, linear algebra), cognitive sciences... without forgetting the specialized knowledge of the domains to which one wishes to apply it. And the algorithms that underlie it are based on approaches that are just as varied: semantic analysis, symbolic representation, statistical or exploratory learning, neural networks, etc.

The present or future sectoral applications are of considerable scope, for example in transport, aeronautics, energy, the environment, agriculture, commerce, finance, defense, security, IT security, communication, education, leisure, health, dependency or disability. Often, the predictive capacity of these technologies is mobilized.

These are all milestones of sectoral applications. Because in reality, behind the concept of artificial intelligence, there are very varied technologies, constantly evolving, which give rise to specific applications for tasks that are always very specialized.

## The foundations of artificial intelligence

### Artificial Intelligence:

*"a branch of computer science devoted to the creation of systems to perform tasks that normally require human*

*intelligence, This generic term encompasses a wide variety of subfields and techniques . " (Chartand et al., 2017)*

### AI specifics & implications:

- Machine Learning & Deep Learning: " Searching for patterns in data and making predictions about the future (Raj & Seamans, 2019) .
- "Algorithm-based decision making & bias (Raj & Seamans, 2010)
- Black-box effect (Faraj et al., 2019)

### A growing literature:

- Economics (Arntz et al., 2016 Brynjolfsson & McAfee, 2014, DeCanio, 2016)
- Accounting and finance (Issa, Sun, & Vasarhelyi, 2016; Kokina & Davenport, 2017) .
- Management and organization (Phan, Wright, & Lee, 2017).
- List of literature
- Technical current
- Current on the uses in the fields of activities (training, marketing, accounting, etc.) .
- Current on behavioral changes (decision, motivation, human management, emotions, etc.)
- Current on ethics.

### New forms of artificial intelligence

The first and also most available form is assisted intelligence to improve the work of employees and organizations (Murray and Pelard, 2017). For example, GPS navigation programs in vehicles that offer directions to the driver and allow them to adjust to road conditions (Murray and Pelard, 2017).

The second form of emerging intelligence is augmented intelligence (Murray and Pelard, 2017). This is described as a form of intelligence that allows "[people and] organizations [to] do things they otherwise could not do, " such as ride-sharing companies that could not exist without the combination of programs that organize that same service (Murray and Pelard, 2017).

Finally, the third and last form of intelligence goes by the name of autonomous intelligence or synthetic intellect and is still under development (Murray and Pelard, 2017). This last form, as its name implies, is characterized by its ability to "learn, " and evokes machines that will one day act on their own through a method of deep data analysis, such as autonomous vehicles (Murray and Pelard, 2017). Moreover, it is precisely this new form of intelligence that artificial intelligence refers to more broadly, and the current transformations that it is generating around the world explain that its advent represents more than the continuation of the third industrial revolution, but rather the beginning of a fourth industrial revolution (Schwab, 2017). Indeed, artificial intelligence and Revolution 4.0 differ from



previous industrial revolutions in several aspects (Schwab, 2017; Murray and Pelard, 2017).

The document published on December 13, 2016 (N° 4594 Tome I - Rapport, Établi Au Nom de Cet Office, Pour Une Intelligence Artificielle Maîtrisée, Utile et Démystifiée, n.d.), addresses the various aspects of the creation and development of algorithms and artificial intelligence concerned by ethical issues and proposes recommendations for each of them. It formulates eight of them, which your rapporteurs summarize below.

1. The general principles of artificial intelligence research  
The development of artificial intelligence must be framed by respect for the fundamental principles of human rights, responsibility, transparency, education and knowledge.

2. Values "programmed" into autonomous systems  
The moral values to be integrated into the algorithms of autonomous systems cannot be universal, and, without falling into relativism, must be adapted to the communities of users concerned and to the tasks entrusted to them. It is important to ensure, from the design of the algorithms, that the multiplicity of values does not make them conflict with each other and does not disadvantage any user group. This implies that a computationally demanding architecture of values and ethical standards must be respected.

3. Ethical research and design methodology  
It is essential that the methodology of research and design of algorithms and autonomous systems fills many gaps. Beyond its teaching, which is currently absent from engineering curricula, ethics must be integrated into many fields of activity. Industrial practices must be more marked by an ethical culture and the community concerned must take up the appropriate subjects and assume its ethical responsibility. Because of the way algorithms work and make decisions, it is necessary to include "black box" type components that can be decrypted a posteriori in order to record information that helps analyze the decision-making and action processes of autonomous systems.

4. Security  
The unforeseen or involuntary behaviors of artificial intelligence systems represent a potentially growing danger. It is therefore essential to reinforce the safety of the use of intelligence systems which, as they become more and more capable, can become dangerous. Researchers and designers of increasingly autonomous systems will face a complex set of technological as well as ethical security challenges.

5. Personal data protection  
One of the main ethical dilemmas related to the development of artificial intelligence concerns data asymmetry, between those who produce it and those who aggregate, process, manipulate and sell it. The protection of personal data must be organized in consideration of different factors: how the "personal" character of a data is defined and identified; how to define the consent to access personal data; the conditions of access and processing of these data; etc.

6. Legal considerations  
The use of autonomous systems raises many questions from a legal perspective. Requirements for accountability, transparency and verifiability of robot actions are essential and existing arrangements need to be improved. For example, transparency of autonomous systems ensures that an artificial intelligence respects individual rights and, when used by an administration, that it does not infringe on the

rights of citizens and can be trusted. In addition, it is necessary to adapt the legal framework concerning the responsibility for harm and damage caused by an autonomous system, as well as concerning the integrity and protection of personal data.

#### 7. Defense and "killer robots"

The use of autonomous lethal weapons, also known as "killer robots", is risky in that their actions could be altered and become an uncontrollable danger, in that human supervision is excluded. These "killer robots", like military drones, are criticized, and the legitimization of their development could potentially create precedents, which from a geopolitical point of view could be dangerous in the medium term, notably in terms of proliferation of these weapons, abuse of their use and rapid escalation of conflicts. Moreover, the absence of design standards does not allow for the adoption of clearly defined ethical rules today.

#### 8. Economic and Humanitarian Issues

The economic and social objective of this report is to identify the key drivers of the global technology ecosystem in this area and to consider the economic and human, and even humanitarian, ramifications in order to suggest key opportunities for solutions.

### C. Information and Communication Technologies (ICT)

The shape of ICT use in today's organization is characterized by an explosion of products and services available not only for the automation of basic transaction processing, but also for systems that support the execution, coordination, control and evaluation of entire business processes (Turban et al., 1998). The multifaceted nature of these technologies implies the need to study the impact of different types of technologies on management practices (Dutta & Manzoni, 1999), for example, argue that ICT adoption corresponds to a progressive process of organizational capability development and strategic impact. On this basis, they differentiate between infrastructure, services and the value of ICT.

The introductory ICT layer contains technologies that are part of the basic infrastructure of the enterprise and form the backbone of the subsequent implementation of information systems. Far from exhausting them, we have addressed the infrastructure in our study by focusing on communication technologies, including employee access to the Internet, e-mail and intranets. The use of technology at this level influences managerial action through automated communication and collaboration (e-mail, intranets) that often cross organizational boundaries. Finally, the current understanding seems to converge towards the idea that the value layer of ICT includes technologies that allow integration and access to what has been called the organizational memory (Watson, 2008); thus supporting managerial decision making.

### 3. Theoretical background

#### Information and Communication Technology, Human Resources Management and Intelligence (AI)

Data access and analysis (DAA) technologies, including data warehouses that provide easy access to enterprise data, database marketing, data mining, OLAP, and statistical sales analysis tools, enable the analysis and identification of "hidden" relationships in large volumes of data to make information available to a wide range of stakeholders across functional boundaries and hierarchical levels.

Management decision support systems (MDS), on the other hand, provide, through DAA technologies, support to managers for decisions on scenario evaluation, strategy implementation monitoring, etc. by dealing with largely unstructured and open-ended questions about unpredictable future events.

In a dynamic and hyper-competitive environment, ICT can be used to transform data into information. However, it is only through people that information is interpreted and transformed into knowledge. In fact, it is the interaction between people, technology and culture, called the "collective mind of the organization" (Weick & Roberts, 1993), that enables the firm to tackle unexpected and new problems (Hutchins, 1991; Resnick et al., 1991).

The characteristic of what is called commitment-based human resource management (Drazin et al., 1999; Lado & Wilson, 1994) is that it increases decentralization and participation, in the sense that problem-solving rights are delegated to people who are in contact with the relevant knowledge. The participation and empowerment of frontline employees can lead to better discovery and use of local knowledge in the organization (Ciavarella, 2003), especially when there are incentives that support this discovery (Argote et al., 2003). Empirical studies of large, established firms indeed confirm that the productivity and innovation performance of firms is related to high degrees of decentralization and involvement, which includes allowing employees to participate in decision making, delegating responsibilities, involving manual employees in formal or informal work teams and/or quality circles, and systematically collecting employee proposals (Datta et al., 2005; Kalleberg & Moody, 1994; Michie & Sheehan-Quinn, 2001).

"AI is iterative and will continue to improve, but it doesn't know much about the context of the question being asked or how to handle it. For AI to be useful in complex searches (not just literature searches) in most legal structures, I believe it will need significant internal knowledge inputs. It is already difficult to do KM properly (or at all). How then are we going to document the historical knowledge of the structure so that a robot can correctly interpret and apply it? What is captured is not really the entire query that is entered into a machine: there is much more to be specified for the machine to provide an answer."<sup>1</sup>

### The importance of ICT

The role of ICT in the success of these efforts can be decisive. Unfortunately, there is a relative lack of empirical research regarding the impact of advanced ICT on business management. This lack of attention is surprising, as it is often argued that ICTs fundamentally challenge traditional ways of doing business, as they enable, and in many cases lead to, dramatic changes in the structure and functioning of organizations.

In the ICT literature, a number of studies have prescribed complementary investments in information technology with employee involvement, empowerment and cultural openness (e.g. (Davenport, 1994; Pfeffer, 1995). It appears, however, that the human capital skills required to effectively

use ICT are the least tangible and perhaps the most difficult complementary resources for the firm to develop.

The exploitation of ICT presupposes a culture that fosters continuous learning and employee empowerment, i.e., motivation, creativity, and networking, among others. It is essential that employees are "multi-skilled" and "multi-functional" to take full advantage of the opportunities arising from ICT adoption. They must have appropriate analytical skills and knowledge and be able to organize activities effectively in a fluid and flexible environment. In addition, they must take initiative and provide leadership in exploring innovative uses of new technologies. Finally, employees must be comfortable in an environment characterized by the need for intensive teamwork and horizontal communication (Spanos et al., 2002).

If the structure provides the skeleton, the management systems are clearly the nervous system through which coordination and control are carried out throughout the organization. Strategic planning, financial control and human resource management (HRM) systems are among the most important.

### Information and Communication Technologies and Human Resources Management

ICT can significantly improve the coordination and control capacity of the firm (Grant, 1998) and, as a result, stimulate increased use of management systems. ICT removes the constraints of distance and time to access necessary information flows and thus improves the coordination of activities within organizational boundaries. In addition, ICT enables the dissemination of organizational and market data that can be a crucial element for effective decision making and control at all levels. ICT affects planning systems by improving organizational communication and increasing organizational flexibility (Bakos & Treacy, 1986). (Tallon et al., 2000).

Is shown that the use of information technology (IT) as a competitive weapon has become a popular cliché, but there is still a lack of understanding of the issues that determine the influence of information technology on a particular organization and the processes that will enable a harmonious coordination of technology and business strategy. found that operations-oriented companies tend to use ICT to improve planning and management support, and to increase the efficiency and effectiveness of core processes in finance and human resources, among others.

Other, natural abilities, intelligence and skills of key employees acquired through formal education and work experience are considered an important part of an organization's human capital (Grant, 1998). (Orlikowski, 2002) suggests that product development competence is embedded in the daily and routine practices of organizational members (Hutchins, 1991). Non-managerial employees are expected to recognize opportunities (Mintzberg & Waters, 1985) and drive organizational performance (Bartlett & Ghoshal, 1993). Empirical work on large, established firms (Smith et al., 2005).effectively confirms that the human capital of non-managerial employees has a positive impact on the firm's knowledge creation capacity.

### The importance of using artificial intelligence in HRM

HR analytics and Big Data have developed with the HR function's focus on leveraging massive data generated by

<sup>1</sup> Commentary by Kristin Hodgins, dated May 24, 2017 under the post I, Robot published on May 17, 2017 by Lyonette Louis-Jacques on the Slaw collaborative blog. Translation is by us.

people and connected objects. Cappelli, Tambe, and Yakubovich ("Artificial Intelligence in HRM: Challenges and a path forward," SSRN Electronic Journal, 2018) identified four challenges to using AI techniques in HR:

The complexity of HR phenomena; constraints imposed by small data sets (AI works poorly to predict relatively rare outcomes); ethical issues and legal constraints, (HR decisions have very serious consequences for employees and fairness is a primary issue. In addition, the legal framework limits the freedom of employers to decide with algorithm-based analytics); employee reaction to management via data-driven algorithms (Frimousse & Peretti, 2019).

Definitions of AI Imitating human functions Marvin Lee Minsky, one of the forerunners of the discipline defines artificial intelligence as "the construction of computer programs that perform tasks that are, for the time being, more satisfactorily accomplished by human beings because they require high-level mental processes such as: perceptual learning, memory organization, and critical reasoning." In other words, an artificial intelligence is above all a computer program aiming at performing, at least as well as humans, tasks requiring a certain level of intelligence. The horizon to be reached therefore potentially concerns all fields of human activity: movement, learning, reasoning, socialization, creativity, etc. The unfulfilled promises of the early days of AI have led to a distinction being made between, on the one hand, machines that would not only implement reasoning similar to human reasoning, but would also have a real awareness of themselves: this is what we call strong artificial intelligence; and, on the other hand, machines that provide numerous services to humans by simulating human intelligence: this is weak artificial intelligence. The objective of AI research Strong artificial intelligence has given rise to many debates about the possible appearance of a singularity, where the machine, superior to the human being and aware of this superiority, would supplant him in society.

#### **Artificial Intelligence, Human Resources Management and ICT**

To date, we are very far from it and the majority of AI researchers even think it is impossible. Weak artificial intelligence will use all the technologies at its disposal to try to provide the service expected by the user. Artificial intelligence originally wanted to simulate the activity of the brain with the hypothesis that we reasoned with rules of inference (logical approach of AI) or later, from the 80's onwards, with formal neurons and then neural networks (at the origin of deep learning that we will present later). Progress in algorithms, formal logic, computing power, and the standardization of computer languages on the one hand, and life sciences and cognitive sciences on the other, have enabled AI to make great strides in each of its research fields (knowledge representation, automatic language processing, robotics, learning, planning and heuristic research, cognitive modeling, etc.), solving increasingly complex problems and creating systems that interact fluidly and efficiently with human beings. According to reports by Inria (2016), France IA, and the Academy of Technologies (2018), artificial intelligence is defined as "an already old scientific discipline (officially dating back to 1956), whose foundations go back to the beginnings of computer science in the 1940s and 1950s, with many different methods, whose purpose is the reproduction of cognitive functions by computer science" (Benhamou and Janin, 2018).

Artificial intelligence aims to "understand how human cognition works and reproduce it; create cognitive processes comparable to those of human beings" (Villani, Schoenauer, Bonnet et al., 2018). Thus, since the 1956 Dartmouth Conference, artificial intelligence has been developing, always pushing the boundaries of what was thought to be done only by humans (Moor, 2006).

#### **4. Measures Of The Variables:**

##### **Measurement Instruments**

The respondent rated each of the four measurement instruments on a five-point Likert scale (1 = strongly disagree and 5 = strongly agree), unless otherwise noted.

##### **Dimensions for HRM**

To assess the HRM measures, we adopted the (Lepak & Snell, 2002) twelve-item scale based on commitment to human resource management, which was also used by (Lopez-Cabrales et al., 2009) in their study. Examples of items from this scale included in the HRM practices scale asked employees to indicate how they perform tasks with a high degree of job security, training to develop organization-specific knowledge/skills, and receive incentives for new ideas, etc. We found that the Cronbach's alpha for the human resource management practices scale was 0.89.

##### **Dimensions for ICT:**

We measured ICT adoption in relation to the following types of technologies (Spanos et al., 2002): management decision support systems (MDS), enterprise resource planning (ERP), data access and analysis (DAA) technologies (i.e., Data Warehouse), and other technologies. i.e., Data Warehouse, Statistical Sales Analysis, Database Marketing, Data Mining, and OLAP), Process Support and Improvement (PSI) technologies (i.e., in logistics, production, statistical quality control, sales and distribution, and customer service), and communication technologies (i.e., employee access to the Internet, email, and intranet); We calculated two composite indices that reflect the current and prospective use of each of these types of ICT. Current usage refers to the total number of applications currently used by a company. Prospective use refers to the total number of technologies that are currently in use or being developed for use in the immediate future.

##### **Dimensions for IA:**

In the literature, we do not have any measure of artificial intelligence, so we tried to measure it using the following 5 elements (automatically generated meeting minutes, the follow-up of actions and collaborators, simplified management of business, automated reporting and simplify mailbox management), selected after the literature review:

Understand exchanges - consolidate, analyze and structure the data:

##### **Simplify mailbox management:**

Follow important mails by turning them into a task on, forward important emails. Artificial intelligence transforms them into tasks to ensure follow-up and traceability, while classifying them in the right project, for the right person and at the right date

##### **Automatically written meeting minutes:**

You send your notes to the assistant and it will write the meeting minutes to save you time. Take notes in an email or a Word document .The Artificial Intelligence creates the meeting minutes for you and stores them in the desired project .To ensure the follow-up of meetings with teams,



Artificial Intelligence automatically extracts decisions and action plans from the notes.

The follow-up of actions and collaborators: talk to the assistant from any tool to ask him to create action plans to be carried out with your team. Create a task from a messaging tool: mail, Skype, Slack, Microsoft Teams...

#### Automatically delegate tasks to collaborators:

Simply specify the date of completion: tomorrow, next month ... and project. The AI takes care of creating the task for the right person at the right time and stores the action in the right project.

#### Simplified activity management:

Artificial Intelligence allows you to visualize in real time the tasks to be done and the progress of your activity. Ask the Artificial Intelligence for the actions to be carried out, the teams or the projects from a daily tool. You can also directly update the progress of action plans from an instant messaging tool by clicking on "edit".

#### Automated reporting:

ask Artificial Intelligence to create specific reports ask for the synthesis of projects, the synthesis of tasks of a collaborator from any tool, send the reporting by email and a follow-up of the progress of the action plans for each collaborator and by project.

#### 5.1. Development of the hypothesis

The main objective of the study was to examine the impact of ICT on HR performance with the mediating mechanism of AI. Taking into account the literature and assumed hypotheses, a theoretical model was developed. The model tested in this study states that ICT behavior favors AI (to increase HR performance) (H1) and that ICT and AI are positively related to HRM performance (H2 and H3), respectively. In addition, AI mediates the relationship between ICT and HR performance (H4). The proposed study design is presented in Figure 1.

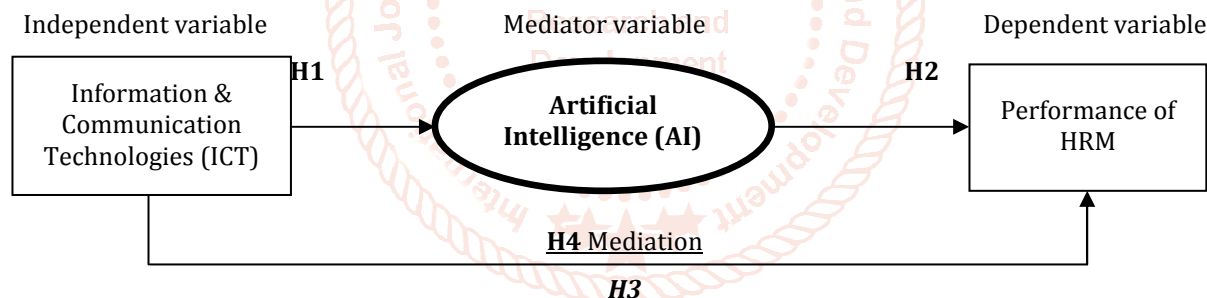


Figure 1: Proposed research model and hypotheses.

## 6. Research Methodology

### 6.1. Method and population

The present study is based on a cross-sectional design and a questionnaire that was used to collect primary data from employees currently working in different HR and communication departments or in information systems departments within SMEs. The companies involved were: food and beverage, pharmaceutical, minerals, consulting and construction. A self-administered version of the questionnaire was distributed to all potential respondents. The confidentiality of the participants' answers was also guaranteed by the authors.

Using a convenient sampling technique, 550 questionnaires were circulated between May and September 2019 in Europe as well as in Africa, Asia .... However, a total of 179 completed questionnaires were received. The drafting of questionnaires that were shared electronically between several language versions (English, French and Arabic).

### 6.2. Sample

In order to achieve this objective, data were collected using a self-administered questionnaire using a convenience sampling technique. This questionnaire is composed of two sections, section 1 contains the demographic questions that group the five items all based on the nominal scale, while section 2 contains the items of the main variables. The ICT scale It is composed of 12 items. While the questions on HR management performance were adopted from previous researchers it is composed of 15 items, and for the measurement, artificial intelligence was composed of 5 items. on total of 40 Items on our research model

To measure the items used in this study, a 5-Likert scale ranging from 1-Strongly disagree to 5-Strongly agree was used.

## 5. Research Framework And Hypotheses

### The Research Model

The research model was developed based on the above literature review and its framework is represented in the following Figure 1.

Information and Communication Technologies (ICT) and Artificial Intelligence:

**Hypothesis 1 (H1):** AI has a positive association with information and communication technologies (ICT).

Artificial intelligence and human resource performance:

**Hypothesis 2 (H2):** AI has a positive correlation with human resource performance.

Information and communication technology (ICT) and human resource (HR) performance:

**Hypothesis 3 (H3):** There is a positive association between AI and HR performance

Mediating role of AI in information and communication technology (ICT) and human resource performance:

**Hypothesis 4 (H4):** AI has a positive mediating correlation between ICT and HR performance.

### 6.3. Validity and reliability

Then, the questionnaire was also tested with 15 selected respondents to verify its content validity and to ensure that the tool used in this study actually measures what is to be measured. The reliability of the scales was assessed in this study using Cronbach's alpha. Indeed, the internal consistency coefficient must be at least 0.60 (Hair et al., 2010; Sekaran & Bougie, 2013). According to the results, we observe that the Cronbach's alpha coefficient varies between 0.609 and 0.649. Therefore, all values are highly reliable since the alpha coefficient is greater than 0.6. Thus, this result indicates a very good intrinsic consistency between the items related to its dimensions, also for each variable, as well as for the globality of the scale.

## 7. Data analysis and discussion

### 7.1. Demographic characteristics of the respondents

The data collected through the questionnaire distributed to the employees were analyzed using Statistical Package for Social Science (SPSS). The following table presents the demographic characteristics of the respondents

**Table 2: The demographic characteristics and statistical information of the respondents**

Statistical information		Gender	Age	Education	Division	Experience	Affiliation
N	Valid	179	179	179	179	179	179
	Missing	0	0	0	0	0	0
Average		1, 57	2, 40	3, 30	3, 23	2, 27	3, 18
Median		2, 00	2, 00	3, 00	3, 00	2, 00	4, 00
Standard deviation		, 496	, 845	, 684	1, 284	, 986	1, 195
Variance		, 247	, 714	, 468	1, 649	, 973	1, 429
Skewness		-, 284	, 085	-, 455	-, 389	, 363	-, 550
Standard error of skewness		, 182	, 182	, 182	, 182	, 182	, 182
Kurtosis		-1, 941	-, 571	-, 818	-, 705	-, 861	-1, 020
Standard error of kurtosis		, 361	, 361	, 361	, 361	, 361	, 361

Gender	
Male	43, 0%
Female	57, 0%
Experience	
Less than 5	24, 0%
5 - 10	39, 7%
10 - 15	21, 8%
More than 15 years	14, 5%
Age	
Under 25 years	14, 0%
25 - 35 years	41, 3%
36 - 45 years	35, 2%
Over 45 years	9, 5%
Affiliation	
Europe	11, 7%
Afrique	22, 3%
America	8, 4%
Asia	51, 4%
Canada	6, 1%
Division	
DSI	16, 8%
Sales	4, 5%
HR	36, 3%
Accounting Customer	24, 0%
Service	18, 4%
Education	
Degree Bachelor's	12, 8%
Degree	44, 7%
Master or higher	42, 5%

### 7.2. Descriptive analysis

The processing of the data collected was carried out in several steps using various statistical methods. First, a validity analysis was conducted and the validity of the research instrument was verified along with descriptive statistics. Thus, content validity was ensured by using items adapted from the literature, and by conducting the pilot study. In addition, convergent validity was tested using exploratory factor analysis to discover the underlying structure of a relatively large set of variables, which were used under a priori assumption that any indicator can be associated with any factor (Hair et al., 2006).



**Table 2: Cronbach's Alpha for the study constructs**

Reliability statistics		
Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of elements
, 609	, 640	34

Table 3: Means, Variance, Full correlation and Cronbach's Alpha for the study constructs

**Table 3: EFA for PHRM, ICT and IA dimensions:**

Representation qualities HRM	
	Extraction
Satisfaction with recruitment	, 679
Team performance	, 728
Employee benefits	, 600
Online recruiting	, 710
Department performance	, 764
Employee performance	, 687
Job satisfaction	, 752
Management performance	, 785
Commuting to and from work	, 606
Social networks in the company	, 685
Managerial Effectiveness	, 601
Employee departure	, 528
Representation qualities ICT	
Management decision support systems	, 751
Enterprise Resource Planning	, 795
Data access and analysis technologies	, 827
Data warehousing	, 510
Statistical sales analysis,	, 824
Database marketing	, 750
Data Mining	, 785
Support Technologies	, 890
Process Improvement	, 782
Statistical Quality Control	, 829
Sales and distribution and customer service	, 820
Communication technologies	, 896
Employee access to the Internet, e-mail and intranet	, 777
Digital security and professional use	, 876
Computer equipment in company	, 650
Representation qualities AI	
Automatically generated meeting minutes	, 771
The follow-up of actions and collaborators	, 523
Simplified management of business	, 427
Automated reporting	, 183
Simplify mailbox management	, 707
Extraction method: Principal component analysis.	

We test for discriminant validity using confirmatory factor analysis to determine the extent to which measures of different variables can be associated with different factors. Next, a reliability analysis was conducted using Cronbach's alpha coefficients, which indicate the internal consistency of the items used to calculate the scales (Feldt & Kim, 2008).

**Table 4: Regression analysis for mediation of the effect of ICT on PHRM through IA**

	Mean	Ecart type	N
PHRM	3, 9069	, 20589	179
ICT	4, 1281	, 26313	179
AI	4, 0302	, 27352	179

Bayes factor inference for matched correlations <sup>a</sup>				
		PHRM	ICT	AI
PHRM	Pearson correlation	1	,342	,240
	Bayes factor		,000	,092
	N	179	179	179
ICT	Pearson correlation	,342	1	,450
	Bayes factor	,000		,000
	N	179	179	179
AI	Pearson correlation	,240	,450	1
	Bayes factor	,092	,000	
	N	179	179	179
a. Bayes factor: comparison of null and alternative hypothesis.				

In the second regression model, the independent variable must predict the mediator. In the third regression model, the mediator must predict the dependent variable. Finally, in the fourth regression model, the independent variable and the mediator must be entered together to predict the dependent variable. If the effect of the independent variable on the dependent variable while controlling for the mediator decreases to zero, then a full mediation effect exists. In the first regression model, information and communication technology (ICT) (the independent variable) is significantly related to human resource management (HRM) performance (the dependent variable), as shown in Table 5 ( $\beta = .342$ ,  $p < .001$ ). Therefore, hypothesis H1 was accepted. In the second regression model, information and communication technology (the independent variable) was significantly related to artificial intelligence (the mediator) providing support for hypothesis H2 ( $\beta = .450$ ,  $p < .001$ ). In the third regression model, artificial intelligence (the mediator) was significantly related to human resource management performance (the dependent variable) providing support for Hypothesis H3 ( $\beta = .240$ ,  $p < .001$ ).

**Table 5: The variance inflation factor (VIF) to assess multicollinearity and R-Square**

Coefficients <sup>a</sup>								
Model		Non-standardized coefficients		Standardized coefficients	t	Sig.	Co-linearity statistics	
		A	Standard error	Beta			Tolerance	VIF
1	(Constant)	2,801	,229		12,254	,000		
	ICT	,268	,055	,342	4,849	,000	1,000	1,000
a. Dependent variable: PHRM								

Coefficients <sup>a</sup>								
Model		Non-standardized coefficients		Standardized coefficients	t	Sig.	Co-linearity statistics	
		B	Standard error	Beta			Tolerance	VIF
2	(Constant)	3,180	,222		14,331	,000		
	AI	,180	,055	,240	3,285	,001	1,000	1,000
a. Dependent variable: PHRM								

Coefficients <sup>a</sup>								
Model		Non-standardized coefficients		Standardized coefficients	t	Sig.	Co-linearity statistics	
		C	Standard error	Beta			Tolerance	VIF
3	(Constant)	2,100	,289		7,276	,000		
	ICT	,468	,070	,450	6,699	,000	1,000	1,000
a. Dependent variable: AI								

Multicollinearity is a potential problem in regression models that can affect the results due to the high correlation between independent variables. We performed the variance inflation factor (VIF) to assess multicollinearity. As we use the VIF value was 1.000. Allison (1999) suggested a cutoff value of 2.5 as a sign of multicollinearity; therefore, multicollinearity was not an issue in this research. To test the research hypotheses, we applied the procedure described by Baron and Kenny (1986). This approach requires conducting four separate regression analyses to identify the existence of a mediation effect. In the first regression model, the independent variable must predict the dependent variable.

Correlations				
		PHRM	ICT	AI
PHRM	Pearson correlation	--		
	Sum of squares and cross products	7,545		
	Covariance	,042		
	N	179		
ICT	Pearson correlation	,342**	--	
	Sig. (two-tailed)	,000		
	Sum of squares and cross products	3,302	12,324	
	Covariance	,019	,069	
	N	179	179	

AI	Pearson correlation	,240**	,450**	--
	Sig. (two-tailed)	,001	,000	
	Sum of squares and cross products	2,403	5,761	13,317
	Covariance	,013	,032	,075
	N	179	179	179
**. The correlation is significant at the 0.01 level (two-tailed).				

In the fourth regression model, information and communication technology and artificial intelligence (the independent variable and the mediator) were regressed together to predict HRM performance (the dependent variable). As shown in Table 5, the direct effect of information and communication technology on HRM performance in the first regression model ( $\beta = 0.450$ ,  $p < 0.001$ ) was reduced in the fourth regression model, but still significant, implying that only a partial mediation effect may exist. To calculate the indirect effect according to (SOBEL 1987), the regression coefficient obtained by regressing the mediator to predict the dependent variable ( $\beta = 0.240$ ) must be multiplied by the regression coefficient obtained by regressing the independent variable to predict the mediator ( $\beta = 0.240$ ). Thus, the indirect effect of information and communication technology on HRM performance by artificial intelligence =  $0.450 * 0.240 = 0.108$ .

**Table 7: Confidence intervals**

	Pearson correlation	Sig. (bilateral)	95% confidence intervals (bilateral) <sup>a</sup>	
			Lower	Upper
PHRM - ICT	,342	,000	,206	,466
PHRM - AI	,240	,001	,096	,373
ICT - AI	,450	,000	,324	,559

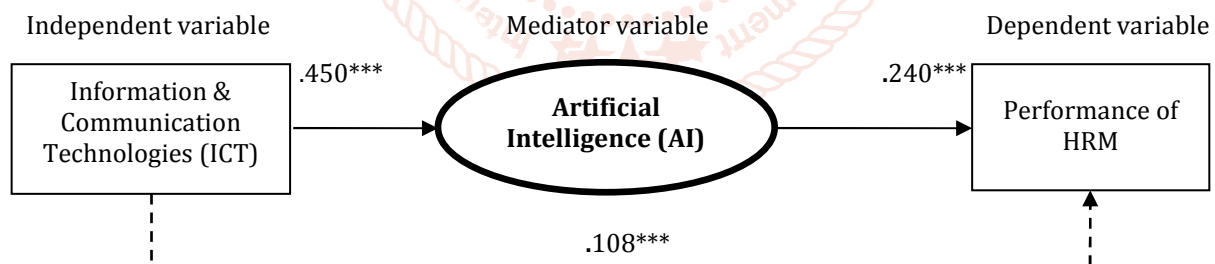
a. The estimation is based on the Fisher r-to-z transformation.

To ensure that the indirect effect is significant, it is recommended to perform the Sobel test. The inputs to the Sobel test are the unstandardized coefficient and standard error of information and communication technology (the independent variable) on artificial intelligence (the mediator), and the unstandardized coefficient and standard error of artificial intelligence (the mediator) on human resource management performance (the dependent variable) when information and communication technology (the independent variable) is also a predictor of human resource management performance. (Nijimbere 2019; Stamatellos and Georgakis 2020), Sobel's test (test formulas provided here are from MacKinnon & Dwyer (1994) and MacKinnon, Warsi, and Dwyer (1995):  $z\text{-value} = a*b/\text{SQRT}(b^2*sa^2 + a^2*sb^2)$ ); showed that artificial intelligence significantly mediates the effect of information and communication technologies on human resource management



**Figure 2: Information & Communication Technologies - HRM performance model**

Note: \*\*\* $p < 0.001$  (direct effect)



**Figure 3: Information & Communication Technologies - Artificial Intelligence - HRM performance model: Note: \*\*\* $p < 0.001$  (indirect effect)**

Therefore, hypothesis H4 was accepted. Figure 2 and Figure 3 illustrate the direct and indirect effects. In addition, Table 8 provides a summary of the hypotheses tested

**Table 8: Summary of results**

Hypothesis	Path	Effect	Result
H1	Information & Communication Technologies -> HRM Performance	.342***	Approved
H2	Information & Communication Technologies -> Artificial Intelligence	.450***	Approved
H3	Artificial Intelligence -> HRM Performance	.240***	Approved
H4	Information & Communication Technologies -> Artificial Intelligence -> HRM Performance	.108***	Approved

## 8. Discussion

Can artificial intelligence improve the performance of human resources management? If the changes that are taking place all over the world favor the emergence of a brutal financial logic, putting the human variable back into play to adjust the company's performance, especially by considering the human element as a cost center, is not likely to perpetuate the company. Indeed, such an action has a positive effect on the company's figures but only in the short term. In the long term, a company that is not built on efficient, innovative and stable human resources will be driven out of the business world. The performance



of the HR function is therefore not easy to define or measure. Indeed, it is a transversal function that contributes to the missions of other functions and, as a result, the fruits of its actions must be sought and developed within the other functions. In addition to this difficulty, the results of the HR function are generally only observable in the long term.

### Balance sheets

Assessment of the general perception of AI in society	Assessment of the perception of AI in companies	Balance sheets on employee perception of AI.
AI is a step in the digital transformation Gap between speeches and practice Fears associated with work, jobs, skills Differences in maturity depending on the culture Cardon, D. (2019); Dessalles, J.L (2019); L'excellent, C., (2017)	Buzz effect Vocabulary New jobs Ethics Experiments Acemoglu, D., & Restrepo, P. (2018) (2019); Bessen, J. (2018); Valerio. De Stefano. (2018).	Job loss Change in work methods Misunderstanding of the global strategy Monera, (2019). Couturier, J.P (2019); Blons, E (2019)

It follows that the theme of "HR performance" remains a fertile field for research insofar as the theme in question is far from clear-cut, despite the convergence towards certain levers likely to ensure the recognition and proper positioning of the function, in this case active participation in the strategy, the improvement of HR processes and the need to establish performance indicators.

The HR department has undergone numerous transformations and evolutions in recent years, and the increasing use of robotics and artificial intelligence (AI) in this professional environment today represents real challenges as well as opportunities.

Logically, and in the same way as each of the departments making up the company, the HR department is already beginning to be impacted by artificial intelligence within its own function. When used wisely, artificial intelligence can allow HR to move away from routine and operational tasks to focus on strategy and people. In this case, artificial intelligence is synonymous with a return to the heart of the HR function. And the heart of the HR function is its ability to think about ethical and legal issues. This is the added value of HR.

After the results of the analyses that we have already made, proving that artificial intelligence contributes to the development of HR, we can now see that the HR function has become a more important one.

AI & Productivity and HRM	AI and focus on value-added tasks	AI, innovation, human dimension human dimension and time saving
"AI will allow ..." Assist management in managing innovation . Take into account data to Make decisions. Automate managerial tasks of organization Automate the managerial tasks of of planning	"AI will allow..." Focus on value-added tasks added (-) Automate the managerial tasks of project management. (-) Automate the managerial tasks of presentation/communication	"AI will allow ..." Promote innovation Assist management in motivating teams. Assist management in managing management. Alert me when there is a problem (-) To put into situation and experiment (-) To have the time to take into the human dimension

The impact of AI practices on HRM can constitute an authority perceived by the other actors of the company (managers and others) which can lead them not to grant these measures a credibility comparable to that which they generally grant to financial data because of their apparent objectivity. In addition, the temporality of HRM decisions makes it difficult to analyse the relationship between the practices tested and performance. The results of human resources actions only become perceptible in the medium to long term. As a result, measuring IA's participation in the HR function and in value creation remains complex.

Human resources management (HRM) has undergone many transformations and evolutions in recent years, and the increasing use of robotics and artificial intelligence (AI) in this professional environment today represents real challenges as well as opportunities. Logically, and in the same way as each of the departments making up the company, the HR department is already beginning to be impacted by artificial intelligence within its own function. When used wisely, artificial intelligence can allow HR to move away from routine and operational tasks to focus on strategy and people. In this case, artificial intelligence is synonymous with a return to the heart of the HR function. And the heart of the HR function is its ability to think about ethical and legal issues. This is the added value of HR. After the results of the analyses that we have already made, proving that artificial intelligence contributes to the development of HR, we can now see that the HR function is not only the most important one, but also the most important one.

For Jean-Gabriel Ganascia, Professor at the University Pierre and Marie Curie (Paris VI), Director of the team ACASA of the laboratory of computer science of Paris VI (LIP6), Member of the board of LABEX OBVIL: he comments on the results of the survey teach us first that more than two thirds of the population (69%) think that artificial intelligence and masses of data (Big Data) will be brought to take a great expansion in the future.

### Conclusions

Human resource management is a common practice wherever there is more than one person, so companies need

to identify what kind of skills and value they need to acquire, and what tools are available to do so. Some of these tools are technological, others are human. A combination of these

solutions is needed. Consider what is available in a business environment and how companies and employees will interact with that technology. It's a transition to a more automated work environment, and the skills needed to facilitate that transition. The big issue for this profession is that in the next ten years, some HR people will be performing tasks that are automated.

Once governance has decided in favor of the human, Heidegger reminds us that the technical mind provides solutions: HR will thus be keen to include AI in the talent pool to advance the company's technical capabilities and increase the range of solutions it can produce. The poetic mind brings meaning: Now, it is meaning that mobilizes and connects. The question then becomes how to develop the poetic spirit of the company in order to re-enchant the business and restore pride to employees so that AI continues to be a tool at the service of aspirations, intentions and decisions that are entirely human?

Artificial intelligence must be considered from a perspective that corresponds to the social expectations of citizens, and issues related to responsibility, ethics and security must be addressed (Benhamou and Janin, 2018).

### Recommendations and limitations of the study

The human resources management (HRM) profession has undergone numerous transformations and evolutions in recent years, and the increasing use of robotics and artificial intelligence (AI) in this professional environment today represents real challenges as well as opportunities. Artificial Intelligence is about to arrive in our offices and totally revolutionize the way we work, for better or for worse. Some AIs promise to make life easier for a good number of employees, to handle recurrent (and not exciting) tasks, so that employees can refocus on their core business: value creation. But these promises of a better and simpler world are not for everyone: AIs will compete with humans for very specific jobs, and will very quickly prove to be superior.

In general, by implementing Artificial Intelligence algorithms, fewer people will be needed to extract and analyze data. But it will take more people to process the implications of the information found by Machine Learning, Deep Learning or Computer Vision.

Training: Artificial Intelligence leads to excellence For Artificial Intelligence to give you a real competitive advantage, you will have to:

strengthen the business skills of your human resources involve them in the AI implementation process make them understand the benefits for them personally and for your company . your resources will only exceptionally compete with AI algorithms: the most repetitive and tedious management tasks have already been replaced by software or machines. In most cases, intelligent algorithms are designed to make your employees' or users' lives easier and will allow them to focus on higher value-added actions, based on information extracted from data streams (candidate scoring, prospect scoring, fraud detection...). In some cases, especially during the implementation process of your Machine Learning algorithm, the Data Scientist will present you with incomprehensible results. This is where your business experts will have their role to play, to point out the limits of the algorithm or to guide the Data Scientist towards another approach ('Intelligence artificielle appliquée, startups et éditeurs', n.d.).

### The HR functions in a context of digital transformations!

- In the digital age, HR practices are changing paradigm.
- These new issues and concerns are pushing organizations to rethink their operating methods in a collaborative direction.
- Artificial intelligence appears to be a social technology focused on people.
- In this context, the concept of artificial intelligence tends to become an axis of development for companies and gives rise to numerous academic works.
- Its multidimensional and multidisciplinary nature makes it a transversal concept in HRM and more particularly in a context of digital transformations.
- This subject, without being innovative, needs to be better defined both at the theoretical level and in its empirical manifestation.

### An adjustment strategies they adopt to cope with the introduction of AI in their work:

#### From assessment to coping strategies:

- Cognitive or behavioral efforts to manage specific external and/or internal demands that put & repudiate or exceed the person's resources (Folkman et al, 1986, Folkman & Moskowitz, 2004)
- 4 categories of coping: reactive, anticipatory, preventive and proactive (Schwarzer & Knoll, 2003)
- People have a basic motivation to obtain, retain, and protect what they have and value Resource Conservation Theory (Hobfoll, 1989, 2012)
- From a perspective of maintaining meaning at work and preserving identity (Wrzeniewski & Dutton, 2001, Ward & King, 2017) Discussion.

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